DiaVest II: A Non-Invasive Glucose Monitoring System for Diabetes Management

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Diabetes is a chronic condition that devastates approximately 10% of the global population, and yet technology aimed at its management is invasive, costly, and solely monitors blood-glucose levels, excluding dangerous heart related complications. In order to address these shortcomings, a cheaper, non-invasive, and holistic end-to-end system to continuously monitor diabetes was developed. Composed of a novel, dual-layer printed circuit board (PCB), hardware harness, machine learning algorithms, and mobile application, this system was capable of recording, offboarding, and processing electrocardiogram (ECG) values in order to continuously, predict blood-glucose levels and heart complications. The novel PCB combined an ECG chip, Bluetooth antenna, and microcontroller so accurate data could be collected non-invasively. Recording ECG values from three leads, the data was then offboarded to an API where three machine learning algorithms processed them. The first algorithm derived critical spatial features from the ECG shape to classify glucose levels, achieving an area under the curve (AUC) score of 94%. The final two models analyzed temporal features of the ECG and achieved 92% accuracy for heart attack detection and 99% accuracy for heart arrhythmia prediction. These algorithms were integrated with an intuitive mobile application that continuously updates patients on the state of their diabetes through numerical and graphical representations of glucose levels, alerting users of dangerous readings. The system was deemed successful as it provides diabetics a complete tool to non-invasively monitor glucose levels and related complications while reducing the annual cost by about $3500 and the risk of death for 700 million people worldwide.

Awards Won: